colored plates, half-tones, and drawings that are both artistic and accurate, it is a delight to the eye. Containing all our species, described in a clear and interesting manner, it is a book that the amateur must have and the professional will have. The illustrated key is a feature novel and invaluable; the idea is so good that we hope to make use of it for the mosses. *A. J. G.*

NORTH AMERICAN THUIDIUMS.

By G. N. Best.

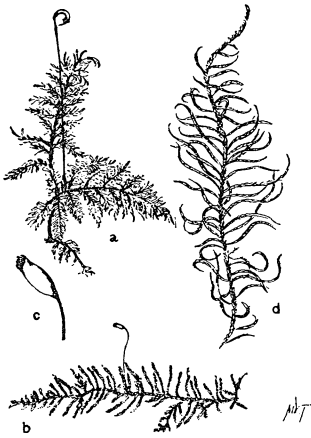

Fig. 1. a, *Thuidium delicatulum* x 1. b, *T. scitum* x 1. c, Capsule of the same x 5. *T. abietinum* x 1.

The Thuidiums are widely distributed and among the most common as well as the most beautiful of mosses. The stems of these plants are complanately branched, pinnate, bipinnate, rarely tripinnate. In most species the branches are so closely set as to give them a plumose appearance which is somewhat distinctive. Although multiform, the paraphyllia are more or less linear or filamentose, often divided and branched, but not foliose. The ovate-triangular stem leaves are usually papillose on both surfaces, unicostate, the costa passing the middle. The median leaf cells vary from roundish quadrate-hexagonal to rhombic-oblong; in two species linear-rhomboidal. The capsules, on smooth pedicels, are annulate, more or less curved. The opercula vary from conic to rostrate; the peristomes well developed; the endostomial band ⅓ the length of the teeth with segments and cilia.

SYNOPSIS OF SPECIES.*

*The species mentioned in Lesquereux & James' Manual of the Mosses of North America and here omitted, are as follows: Thuidium erectum is T. delicatulum; T. calyptratum is a form of T. microphyllum; T. Alleni is a dubious sterile form probably of T. delicatulum; T. remotifolium is not a Thuidium and T. tamariscinum is not known from North America.

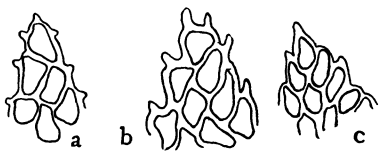

Fig. 2.

Apical cells of branch leaves crowned with 2-4 papillae (Fig. 2, a and b); median cells quadrate-hexagonal to oblong-rhomboidal (Fig 5).....A

Apical cells of branch leaves with a single terminal papilla (Fig. 2, c); median cells as in A. Paraphyllia numeros, branched.....B

Apical cells of branch leaves not papillose; median leaf cells linear-rhomoboidal (Fig. 10). Paraphyllia long linear or filamentose (Fig. 3, c)...C

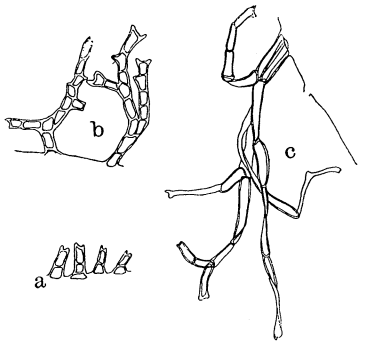

Fig. 3.

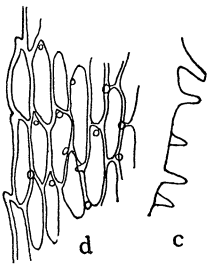

Fig. 10.

A.

Paraphyllia few, small. linear oblong, 2-6 cells long (Fig. 3, a); branch leaves subcrispate-incurved when dry.....1

Paraphyllia numerous, more or less branched (Fig. 3, b)..... 2

1

Fig. 4.

Plants very small, 1-2 cm.; stem and branches filiform, branches papillose (Fig. 4); growing in thin mats on limestone rocks..... ..... *pygmaeum.*

Plants small, 2-4 cm., loosely caespitose; branches smooth; growing on the ground and rotten wood.....*minutulum.*

2

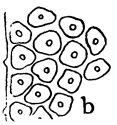

Fig. 5.

*Stems closely pinnately branched, branches terete-foliate when dry.

Plants soft; leaf cells with 2-5 small papillae on each surface (Fig. 5, a).....*scitum.*

Plants rigid; leaf cells with a single papilla on each surface (Fig. 5, b)..... .....*abietinum.*

**Stems loosely pinnately or bipinnately branched.

Fig. 6.

Fig. 7.

Pinnate or bipinnate: stem leaves spreading-recurved when moist (Fig. 6), costa subpercurrent; perichaetical bracts not ciliate....*recognitum.*

Bipinnate or tripinnate; stem leaves erect-spreading when moist (Fig. 7), costate to 4-5; perichaetical bracts ciliate .....*delicatulum.*

Bipinnate; stem leaves with a hyaline filiform acumination; perichaetial bracts scarcely ciliate.....*Philiberti.*

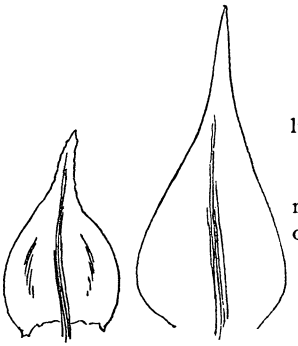

Fig. 8. Fig. 9.

B.

Stem leaves (Fig. 8) roundish ovate, abruptly linear-oblong acuminate, margins erose-serrate. *Virginianum.*

Stem leaves broadly ovate, long and narrowly acuminate, margins crenulate-serrulate or entire (Fig. 9).....*microphyllum.*

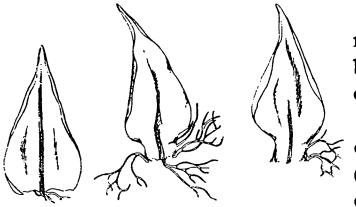

Fig. 11. Fig. 12.

C.

Stem leaves plicate-striate, the decurrent base with one to three cilia (Fig. 11); branch leaves loosely appressed when dry.....*paludosum.*

Stem leaves sulcate, contracted to a decurrent subclasping paraphyllose base (Fig. 12); branch leaves subcrispate when dry.....*Blandowii.*

THUIDIUM PYGMÆUM Br. & Sch. For fineness and for beauty this little moss, appearing when dry like miniature embroidery, leads the Thuidiums. The paraphyllia, found only on the branches, are so small as easily to be overlooked. The median leaf cells of the triangular-ovate stem leaves are quadrate-hexagonal and the operculum of the asymmetric oblong ovate capsule obliquely rostrate; monoicous; spores maturing in autumn. Canada, Ohio, New Jersey, and Pennsylvania.

THUIDIUM MINUTULUM (Hedw.) Br. & Sch. Although quite small this species differs from the preceding chiefly in being larger. Paraphyllia on both stems and branches; median leaf cells quadrate-hexagonal, the marginal somewhat larger; monoicous; capule oblong-oval, rough, slenderly rostrate.

Its usual habitat, in the northern part of its range, is rotten wood; in its southern, the ground. The spores mature in autumn. From New Brunswick to Minnesota and from Canada to Florida.

THUIDIUM SCITUM (Beauv.) Aust. This neat trim moss grows in mats on the roots and bases of trees. Stem leaves broadly triangular, auriculo-

cordate, narrowly acuminate; median leaf cells roundish hexagonal with 2 to 5 small bead-like papillae on each surface; monoicous; capsule cylindrical, straight, or but slightly curved; operculum conic-rostrate; spores maturing in autumn and winter. Var. *æstivale* (Aust.); stems not so closely pinnate; capsule oblong-cylindrical, inclined to horizontal; operculum shorter beaked—From Canada to North Carolina and from Vermont to Wisconsin.

THUIDIUM ABIETINUM (L.) Br. & Sch. Plants rather large, stiff, in dense tufts, usually on rocks and stones, rarely on the ground; stem leaves broadly ovate, acuminate, deeply biplicate, margins serrulate; median leaf cells oval-rhombic; dioicous; capsule narrowly cylindrical, curved; operculum long conic. From Greeland to Virginia and from New Foundland to British Columbia. Fruiting in Colorado and Montana and fruiting freely in Alaska.

THUIDIUM RECOGNITUM (Hedw.) Lindb. Much difficulty has been experienced in discriminating between this and the following species. They not infrequently grow together. Intermediate forms, however, are rare, probably owing to the difference in their fruiting seasons. The broadly triangular, auriculo-cordate, abruptly acuminate stem leaves are sulcate when dry, spreading-recurved when moist, usually plane on the serrulate margins; costa subpercurrent, somewhat spreading at apex; median leaf cells oblong-rhombic, passing to oblong-linear in the acumen; dioicous: capsule cylindrical, curved: operculum rostellate. On the ground, rotten wood, stones and rocks. Spores mature in July. From Labrador to British Columbia southward, rare or absent on the Pacific slope and in the Gulf States.

THUIDIUM DELICATULUM (L.) Mitt. Stem leaves triangular-ovate, rather gradually acuminate, appressed when dry, erect-spreading when moist, margins serrate, more or less recurved; costa vanishing in the acumen: median leaf cells quadrate-oblong to oval rhombic: perichaetial bracts cilate; dioicous; capsule cylindrical, curved; operculum conic-rostrate; spores maturing in winter. On the ground, rotten wood, stones and rocks. From Labrador to British Columbia southward through the United States, rare west of the Rocky mountains.

THUIDIUM PHILIBERTI Limpr. The distinguishing character of this rare species is the hyaline, filiform acumination of the stem leaves which are somewhat intermediate between those of T. recognitum and T. delicatulum; the median leaf cells are quadrate-oblong rather than oblong-rhombic: costa thin, disappearing above the middle; dioicous; capsule cylindrical, curved: annulus not clearly differentiated; operculum conic-rostrate; spores maturing in October. On swampy ground and about the base of small trees in wet places. New Jersey, Pennsylvania, Ontario and New Brunswick.

THUIDIUM VIRGINIANUM (Brid.) Lindb. (*T. gracile* var. *Lancastriense* S. & L.) Plants small, dark or dirty green, in open woods, on the ground or about stumps and roots of trees. Margins of the roundish ovate stem leaves erose-dentate below, serrate above; acumen of the branch leaves short, broad, sharply serrate; median leaf cells quadrate-hexagonal; mon-

oicous; capsule cylindrical, curved; operculum short beaked, obtuse; spores maturing in spring. From Massachusetts to Minnesota, south to Mexico.

THUIDIUM MICROPHYLLUM (Sw.) Best. (*T. gracile* Br. & Sch.) Plants of medium size, pale green, becoming yellowish. Stem leaves broadly ovate to ovate-lanceolate, long and narrowly acuminate; margins sinuate-serrulate or entire: costa subpercurrent; median leaf cells quadrate-oblong to oval-rhombic; monoicous; capsule oblong, curved; operculum short conic, acute or obtuse, spores maturing in summer.—Var. *Ravenellii* S. & L.; a stunted form growing in sands or on stones in the Southern States.—Var. *lignicola* (Kindb.); somewhat larger than the type, yellowish or rufescent, margins of stem leaves more or less recurved, median leaf cells rhombic to short rhomboidal, capsule more turgid. Northward and westward—on rotten wood, bark of decaying trees, rarely on stones or the ground. From New Mexico to Florida, nothward to Canada, westward to British Columbia.

THUIDIUM PALUDOSUM (Sulliv.) Rau & Herv. (*Hypnum paludosum* Sulliv.) Stem leaves somewhat rigid, oblong-lanceolate, acuminate, plicate-striate, with 1 to 3 cilia on each side of basal margins; costa subpercurrent; median leaf cells oblong to linear-rhomboidal, smooth or with a small papilla at the distal end of each on the lower surface, rarely on both; monoicous; capsule oblong-cylindrical, curved; operculum conic, apiculate; spores maturing in winter—var. *elodioides* (R. & C.); often dark green, leaves smaller, more strongly papillose, papillae sometimes subcentral, margins dentate-serrate. New York westward. On the ground in swamps and grassy fields. From Massachusetts through the Middle States to Indiana.

THUIDIUM BLANDOWII (W. & M.) Br. & Sch. Plants large, erect, soft; stems and branches enveloped in a paraphyllose tomentum; stem leaves ovate-triangular, narrowly acuminate, margins sinuate-serrulate, costa disappearing above the middle; median leaf cells oblong-fusiform to linear-rhomboidal with a large papilla on the distal end of each on the lower surface, smooth or nearly so on the upper; monoicous; capsule oblong cylindrical, curved; operculum conic; spores maturing in July. On marshy ground, with a northern range. From Greeland to Vermont, southward to New Jersey, westward to Idaho and British Columbia.

DESCRIPTION OF FIGURES IN THE KEY.

Fig. 2. Apical cells x 430; a, of *T. minutulum;* b, of *T. delicatulum;* c, of *T. Virginianum.* (Papillae on surface of cells not shown.)
Fig. 3. Paraphyllia x 215; a, of *T. minutulum;* b, of *T. delicatulum;* c, of *T. Blandowii.*
Fig. 4. Portion of branch of *T. pygmaeum* x 110.
Fig. 5. Leaf cells x 430; a, of *T. scitum;* b, of *T. abietnum.*
Fig. 6. Stem x 15 and leaf x 20 of *T. recognitum.*
Fig. 7. Stem x 10 and leaf x 20 of *T. delicatulum.*
Fig. 8. Leaf of *T. Virginianum* x 60.
Fig. 9. " " *T. microphyllum* x 60.
Fig. 10. Leaf cells of *T. Blandowii* x 430; c, papillae on back of leaf seen in profile.
Fig. 11. Leaf of *T. paludosum* x 12.
Fig. 12. Leaves of *T. Blandowii* x 12.

(The editors are responsible for the illustrations in this article as Dr. Best left the matter in their hands when he sailed for Europe.)

Plate IX. 1. *Thuidium pygmaeum* 2 *T. minutulum* 3 & 6. *T. paludosum* 4 & 5. *T. Blandowii* 7. *T. delicatulum* 8. *T. recognitum.*